of dietary components, especially phytates and polyphenols in cereal and legume-based diets. Biomarkers of bioavailability, therefore, have considerable practical importance for the design of intervention strategies aimed at improving iron nutrition. Heme iron is virtually always well absorbed; whereas, most food iron is present as non-heme forms. Bioavailability is markedly affected by meal composition. Several indirect methods for estimating bioavailability has been developed over the past half-century and calibrated against human isotopic absorption studies [6]. Thus, it is essential to create awareness on the excessive intake of iron from food.

The purpose of this review paper is to uncover the effect of iron overload from food, identify various forms of iron in food, the importance of estimating iron intake, types of iron overload and iron bioavailability. To sum up, studies on the effect of iron overload are limited and this study is a topic that should not be overlooked been that most individuals are liable to suffer from hemochromatosis due to lack of information.

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GROWTH REGULATORS AS VITAL COMPONENTS FOR CULTIVATING HAIRY ROOTS OF CHICORY (*CHCORIUM INTYBUS*)*

Keywords: hairy roots, culture, agrobacterium, medicinal, Chicory.

The functionality of cell culture can be assessed by implementing tangible reproducible measurement that is paramount in identifying actual metabolic activities at specific growth levels. The growth profile of plant cell cultures is relatively the same as the growth profile of microorganisms [1]. Hairy roots are manifestation of infection caused by *Agrobacterium rhizogenes* and are obtained from plants that have been infected and damaged through an infestation activity caused by *Agrobacterium rhizogenes* this gram-negative bacterium [2]. Thus, the mechanism of hairy roots disease was utilised in plant biotechnology, in order to develop a substantial application called hairy root culture, which is basically the manipulation of the Ri-plasmid from a desired foreign gene selected to be introduced into monocotyledon or dicotyledon plants that are liable to infection by *Agrobacterium rhizogenes* [3].

The most common culture media used in cultivating plant cells, seedlings, callus and hairy roots of plants is the Murashige and Skoog media, and in which case implores artificial growth regulators and stimulators in the presence of cytokine and auxin activity like naphthalene acetic acid, kinetin and 2,4-dichlorophenoxyacetic acid which helps in promoting cell division, elongation and serves as a herbicide to destroy unwanted plants. This type of culture media has been used in the production of transgenic medicinal plant like *Chicorium intybus* via in vitro *a* technique that utilises the aforementioned culture media to produce better outcome [4, 5] and the growth rate of hairy root culture was found to be greater than that of plant cell cultures [6]. Hairy root cultures in hold differentiated tissues of biosynthetic abilities [7, 6]. The growth rate of hairy root culture is greater than that of plant cell cultures [7].

Chicory (*Chicorium intybus*) is a medicinal plant from the family of Asteraceae. It is a perennial herbaceous plant that can be consumed as medicine and food. Its rich healthy properties include; hypoglycaemic and detoxifying agents [8]. Fresh chicory roots contain 68 % inulin while, dried chicory root extract has 98 % of inulin which serves as a sweetener and prebiotics [9].

Chicory contains chicoric acid, sesquiterpene lactones, coumarins, flavonoids, phenols and vitamins [10]. Whereas, biomass from *Agrobacterium rhizogenes* of transformed root cultures of Chicory can serve as a substitute source to produce hydroxycinnamates alongside proper instructions of the anti-oxidative, anti-radical, and hepato-protective activities [11]. There are benefits in using growth stimulators in cultivating hairy roots of chicory [12].

This work aims to cover the experiments that have been carried out on hairy roots of Chicory using *Agrobacterium rhizogenes* during production thereby,

highlighting the benefits of growth regulators on Chicorium *intybus.* The study will include; evaluation of the biomass used for producing plants through *in vitro* method of hairy root systems for Chicory production.

In conclusion, experiments that have been done using hairy root cultures to produce chicory are limited, but previous studies have demonstrated that chicory can be cultivated with the aid of growth regulators in hairy root cultures to yield enough bioactive compounds.

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